

科技與生活

Wireless Technologies



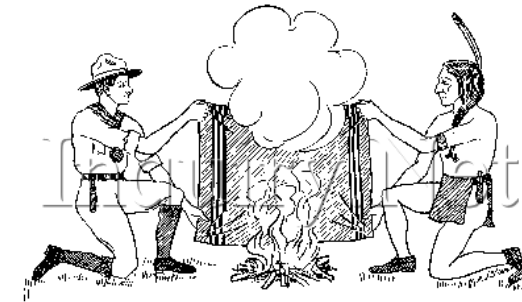
James Clerk Maxwell



電子系暨電信所
洪萬鑄



Wireless Communication ?



SMOKE SIGNALS

Transportation

Critical Infrastructure

Global Networking: Ready for Future Roles?

Telecommunications Banking & Finance

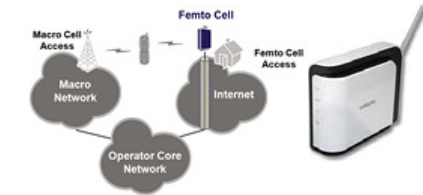
GOVERNMENT SERVICES
FEDERAL
STATE
LOCAL

The Latest Buzz

Open Access:
Google's Android Phone



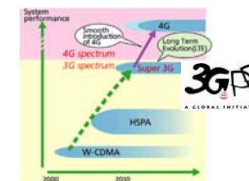
ANDROID



Femtocells

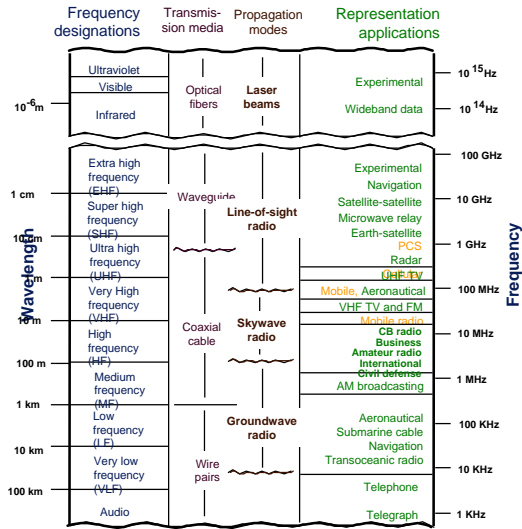


WiMAX versus LTE



700 MHz FCC Auction: Open Access

Frequency Band Allocation

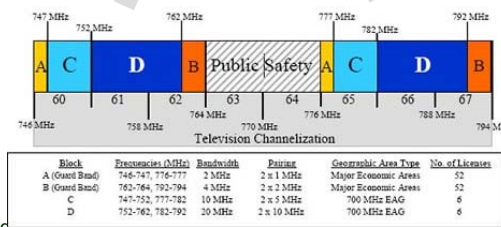
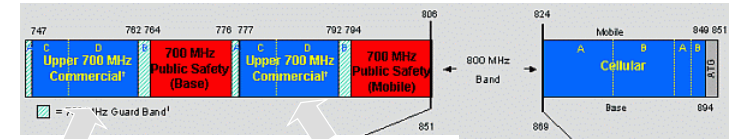


- ◆ Dispersion over distance causes fading effects
 - terrain
 - structures
- ◆ Applications dependent on available technology
 - lower frequencies occupied by existing services
 - new technologies supported at higher frequencies

Industry Canada
 Federal Communications Commission (FCC)
 World Radio Conference (WRC)

The Latest Buzz: 700 MHz FCC Auction

- 700 MHz FCC Auction
 - Beachfront property
 - Total bid amount \$19,561,291,200
 - Bidding will conclude on 2009
 - Google bid 4.6 billion for a third of the spectrum to ensure open access
 - winner will have to allow access to the spectrum to any device or application



Google's Android Phone

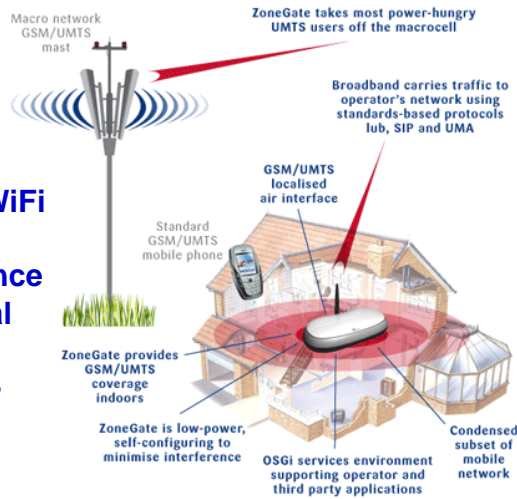


The Latest Buzz: Open Access

- What is Open Access?
- Open devices, open applications, open services, and open networks
- 700 MHz FCC Auction: open devices and open applications
- Google's Android Phone
 - **Must See Video Introduction: Sergei Brin (Google Founder)**
 - Android SDK
- Open Handset Alliance
 - **Software stack for mobile devices that includes an operating system, middleware and key applications**
- Benefits
 - **Open applications: Free to choose applications, content or services**
 - **Open devices: Free to use handheld device of choice in wireless network**
 - **Opens up opportunities to develop a host of new solutions**

Femtocells

- Femtocell
 - In-home wireless access point
 - Competing with WiFi
 - Improve cellular system performance
 - Ubiquisys, several large vendors (Samsung, Nokia-Seimens, etc)

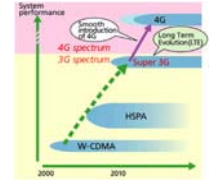


Source: Alcatel 2006

Source: www.3g.co.uk/PR/Feb2007/ZoneGateInHome.gif

The Latest Buzz: WiMAX Versus LTE

Differentiators	WiMAX	LTE
		
Network/Legacy	No legacy dependency – simple IP infrastructure	Legacy 3GPP – complex infrastructure
Market Readiness	Standards: 2006 Commercial: 2007-	Standards: 2009 Commercial: 2010
Market Momentum	Fixed Wireless New entrant to mobile wireless: Greenfield and developing regions	3GPP leading globally Developed world - Verizon, Vodafone, China Mobile, NTT DoCoMo and AT&T



The Pioneers of Mobile Communication



It all started 100 years ago

Heinrich Hertz, 1857-1894

- Electromagnetic waves 1887



Guglielmo Marconi 1874-1937

- First radio 1897



Reginald Fessenden 1866-1932



- Voice transmission over radio 1906

The Titanic

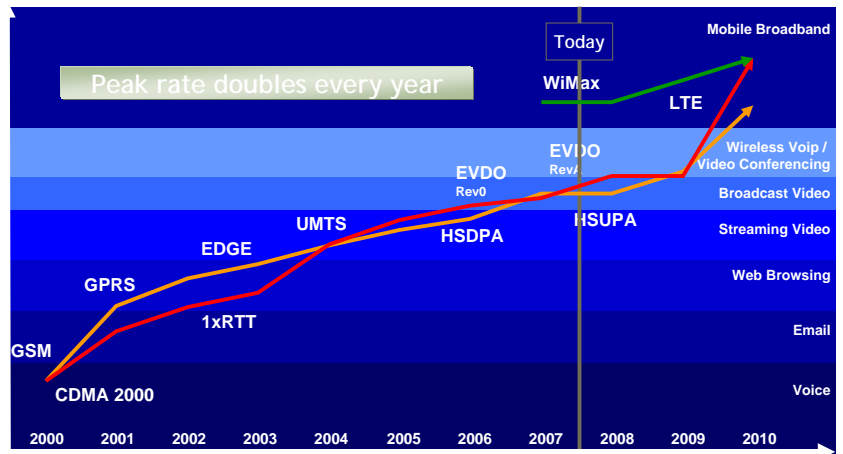




Responding to Crisis -- Performance Matters

	Cellular Digital Packet Data	CDMA2000 1x EV-DO Rev 0	CDMA2000 1x EV-DO Rev A
 <p>Mugshot Download</p> <p>352x375 pixels jpeg 20 kbytes</p>	12.1 kbps down 9 kbps up 13 secs	2.4 Mbps down 153.6 kbps up 0.067 secs	3.1 Mbps down 1.8 Mbps up 0.051 secs
 <p>High Resolution Incident Still Photo</p> <p>287x308 pixels gif 47.2 kbytes</p>	31 secs	0.157 secs	0.121 secs
<p>Download:</p> <p>1400x1050 pixels jpeg 140 kbytes</p>	93 secs	0.467 secs	0.361 secs
<p>Upload:</p>	124 secs	7 secs	0.623 secs
2009 Spring	18	NCUE EE & ICE	

Broadband Wireless Technologies



As bandwidth becomes ever faster and cheaper, ubiquitous broadband coverage becomes a reality creating real change for all...

Increasingly Complex and Critical

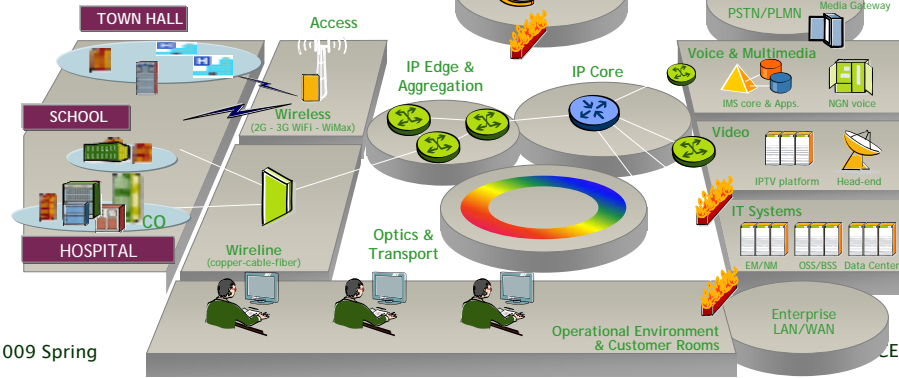


- Securing personnel and assets against operational incidents and terrorism
- Preventing ecological disasters through secure, reliable SCADA
- Enabling rural doctors to save lives with real-time specialist consultation
- Providing interoperable communications between emergency services

Business critical communications solutions address a complex customer environment: Growing mobile workforces; need for reliable, redundant secure connectivity; integration of new and legacy applications

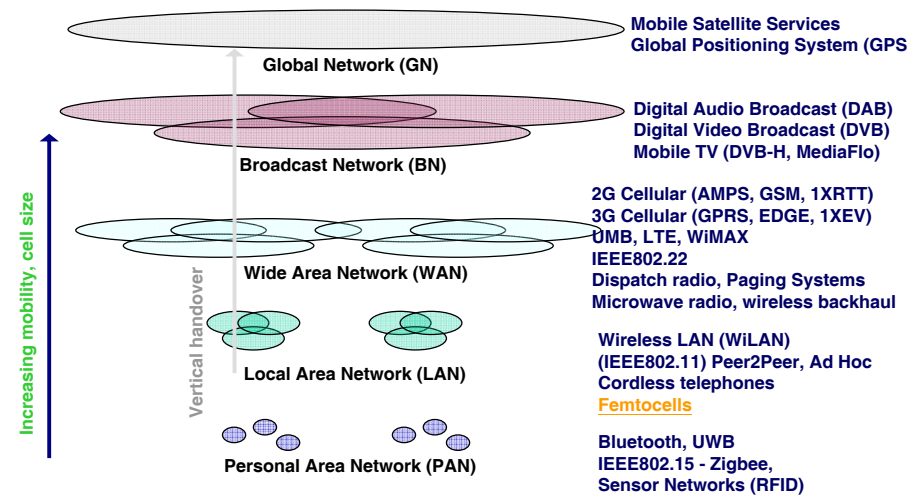
End to End Business Critical Network

- Local authorities are changing from traditional voice and basic interoffice communications to high-bandwidth services with extensive use of video and data
- Unprecedented amounts of bandwidth are required to support this new scenario
- Existing networks are built on legacy technologies that are difficult to scale or adapt to changing needs



2009 Spring

Wireless Systems



2009 Spring

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NCUE EE & ICE

Mobile Computing/Entertainment/Comms



iPoD: impact of disk size/cost



Samsung Cameraphone w/ camcorder



Blackberry: phone + PDA



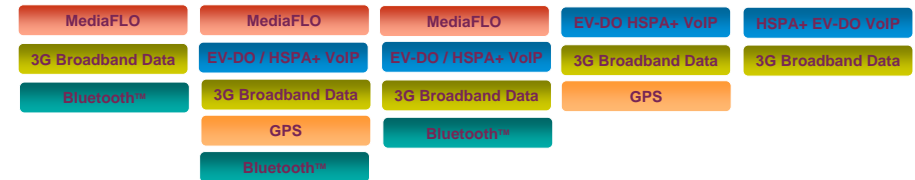
SONY PSP: mobile gaming

23

NCUE EE & ICE

- Computing: smaller, faster
- Disks: larger size, small form
- Communications: wireless voice, data
- Multimedia integration: voice, data, video, games

A Day in the Life of a World Cup Fan

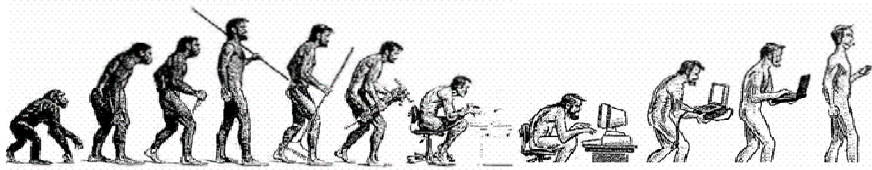


2009 Spring

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NCUE EE & ICE

Evolution of Wireless Communication



Laptop: Mobile computer

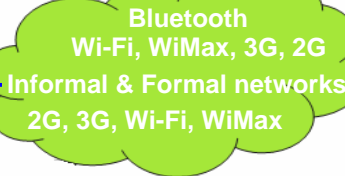


Servers, Databases

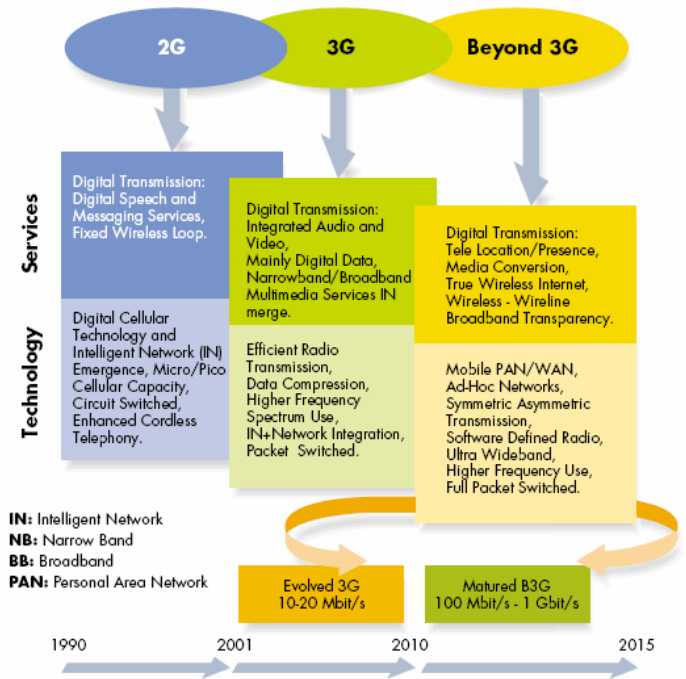
Necktop: Brains



Pockettop: Mobile phone



EVOLUTION



Wireless Broadband Evolution

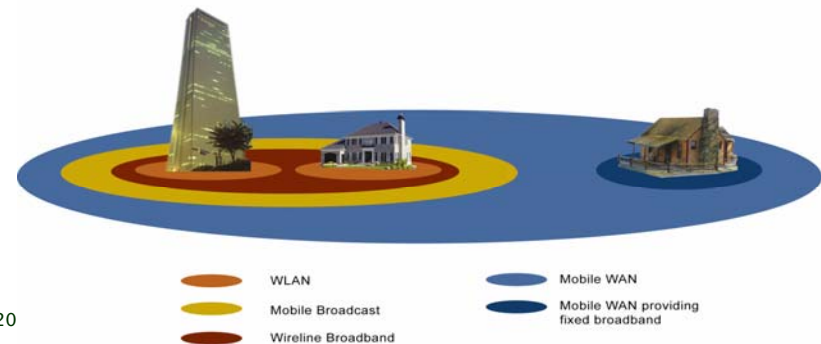


Network Evolution	Mobile Device Evolution	Service Evolution
<ul style="list-style-type: none"> All-IP Network For Fixed-Mobile Convergence (VoIP & data) Co-existence of Different Access Networks for Various Needs <ul style="list-style-type: none"> Coverage, Mobility, Capacity, QoS, Data Rates ... 	<ul style="list-style-type: none"> Convergence of Communication, Computing & CE Platforms Multi-mode Devices Connect to Various Access Networks <ul style="list-style-type: none"> Service Requirements, Availability, Cost ... 	<ul style="list-style-type: none"> User Behaviors Trend from Wired to Wireless Same Rich IP Apps and Services in all Environments <ul style="list-style-type: none"> Ubiquitous & Consistent Experience Desired

Multiple air interfaces supported with a common all-IP based core network

Network Evolution: The Right Technology for the Right Service

- Selection of access based on service requirements, availability, cost
- Full range of devices access the same content across different IP networks



Device Evolution: Convergence of Communication, Computing & CE Platforms

- Multimode devices supporting several air interfaces
 - PP, PP2, GPS, FLO/DVB-H, 802.11
 - Embedded WAN in CEs
 - Handset acts as WAN gateway to CEs (via 802.11, UWB or Bluetooth)
- Continued advances of device capabilities
 - New class of computers -- Ultra Mobile PCs
 - Mobile microprocessors
 - Dual CPU - Up to 1 GHz
 - Multimedia
 - 3D Graphics, camera, video, display, gaming, mp3 players
 - Large storage capacity for personal media library
 - Video, pictures and music
- Integration at silicon level for lower cost, improved form factor and increased battery life



Ultra Mobile PC

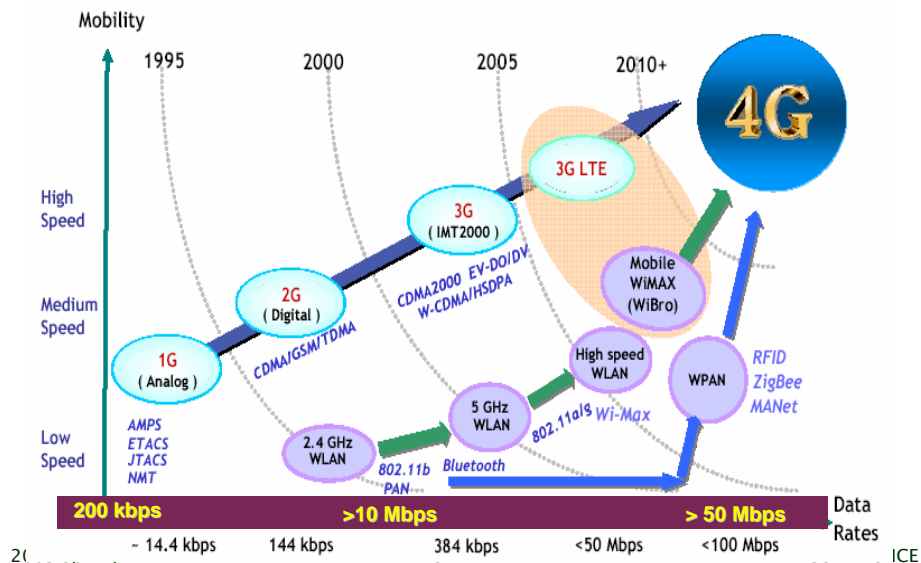
Service Evolution: Same Rich IP Apps and Services in all Environments

- User Trends Shift from Wired to Wireless
 - Ever increased demand for more and higher quality video
 - Users sharing content within a traditional fixed environment (wireless through the home)
 - Place-shifting of content now accessible at all times and places with wireless
 - Introduction of mobile real-time TV services via multicast technology
- Individuals becoming content creators
 - Handsets now becoming media generation and storage devices
 - Wireless connection to social networks allows users to express themselves anytime, anywhere

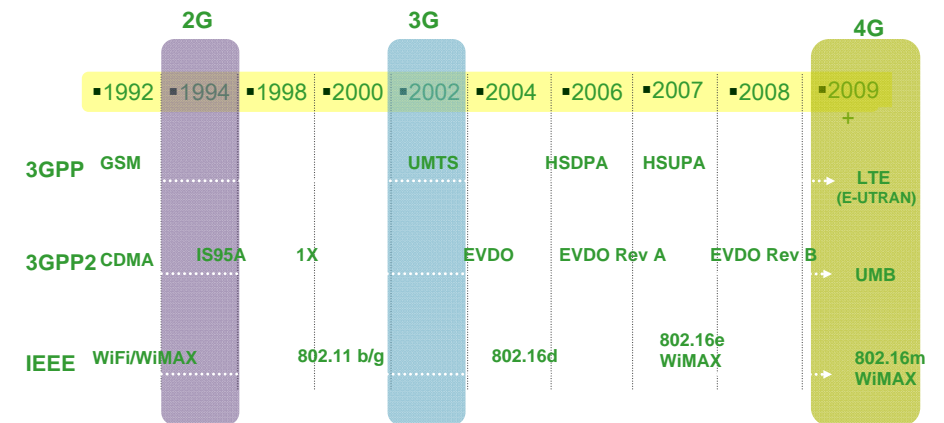


User Generated Content on Social Networks

All Roads Lead to 4G (Eventually)

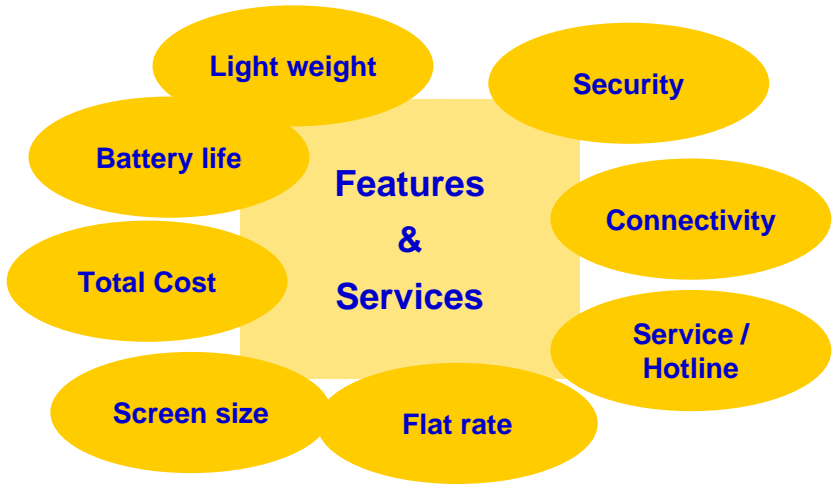


Wireless Broadband Wide Area Standards Landscape



Effects of Device Portability

One size does not fit all anymore...



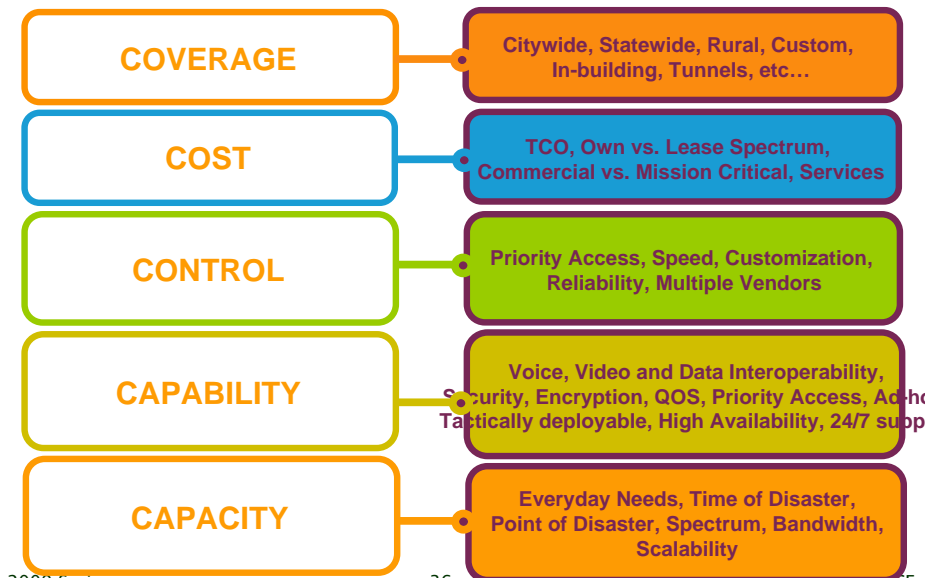
Vehicle Accident

- Video increases emergency room doctor's knowledge of the mechanism of injury, enabling quicker and possibly more accurate treatment
- Biometry data from Incident Scenes enable real time monitoring of Patients on the way to the Hospitals

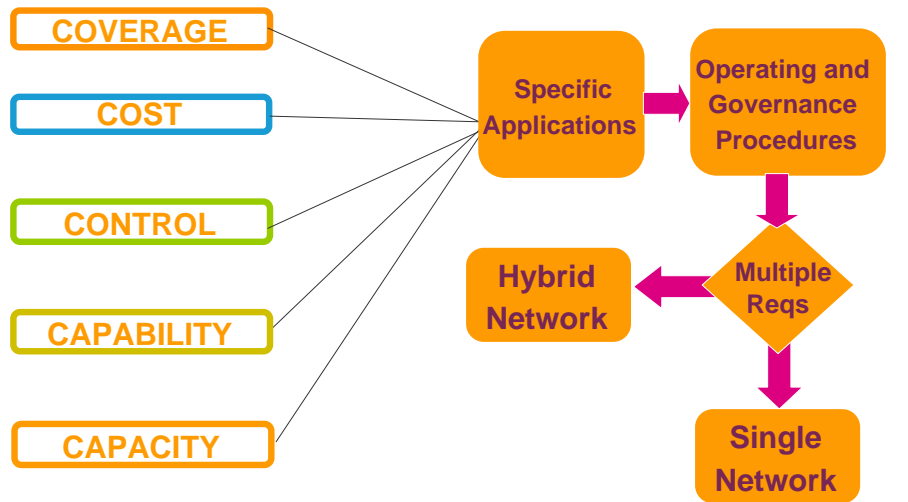
Remote Medical Diagnosis

- Remote diagnosis can shorten the time before treatment which can potentially save lives and shorten recovery time

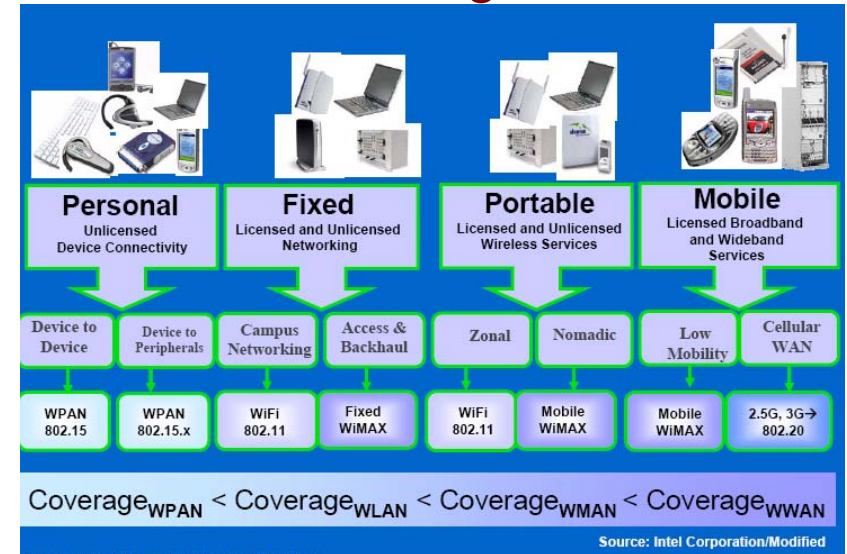
Wireless Network Design Variables: 5 C's



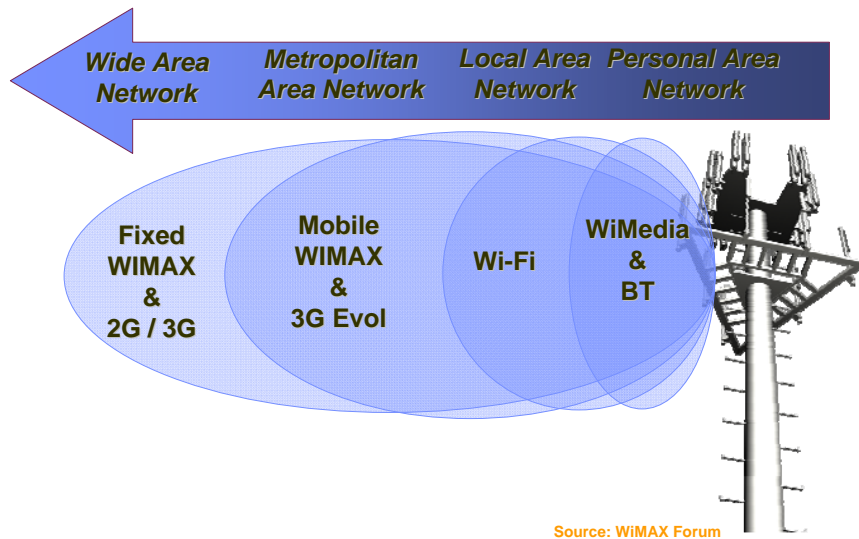
Wireless Technology Solutions Vary from One County to the Next



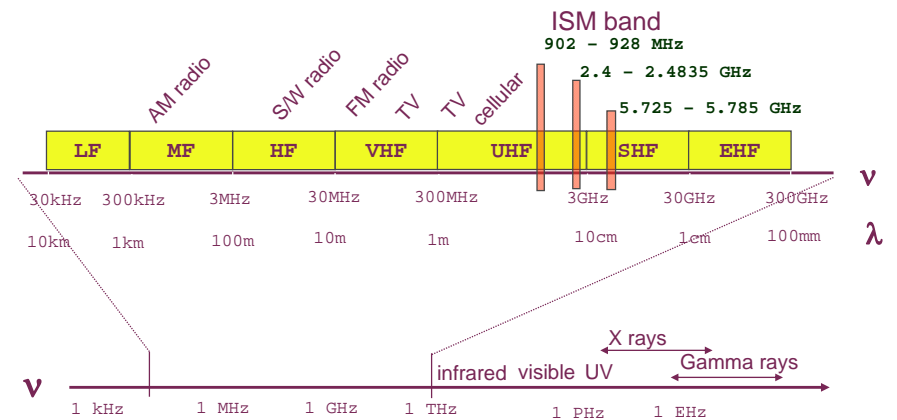
Wireless: The Big Picture...



Broadband Wireless Technologies

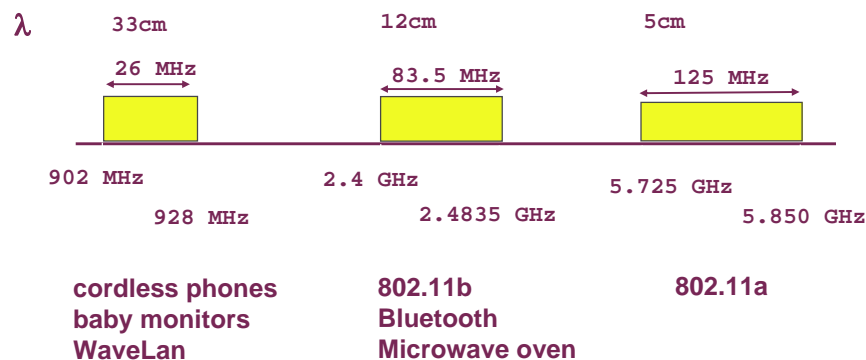


EM Spectrum



Propagation characteristics are different in each frequency band

ISM Radio Spectrum (In Use)



Spectrum Regulation

- Spectral Allocation in US controlled by FCC (commercial) or OSM (defense)
- FCC auctions spectral blocks for set applications.
- Some spectrum set aside for universal use
- Worldwide spectrum controlled by ITU-R

Regulation can stunt innovation, cause economic disasters, and delay system rollout

ITU-R: International Telecommunication Union-Radio Communication Section

FCC: Federal Communications Commission

OSM: Office of Surface Mining

Interplay among Alternative Technologies

- The Game
- The hunter has the power to decide who wins



From Dr. C.K. Mao: Telecom Regulation (APEC Workshop)

Broadband Over Power Lines: *The Third Wire*

- Based on additional analyses, NTIA recommended several supplements to the FCC proposed BPL rules to reduce risk of BPL interference (June 2004)
- The FCC adopted rules incorporating most NTIA recommendations on October 14, 2004.
- Today, many utilities, hotel operators and others are deploying experimental and operational BPL systems.



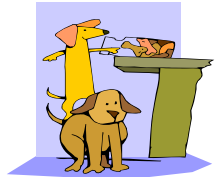
HomePlug Modem can turn an electrical outlet into an Internet connection.

Cognitive Radio

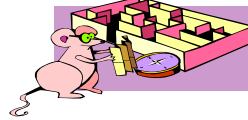
Fixed radios
are set by their operators



Adaptive radios
can adjust themselves to accommodate anticipated events



Cognitive radios
are aware of their environment and learn how to adapt

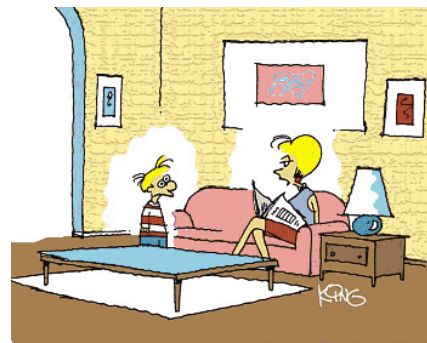


BBC News

“... Doctors at a Welsh hospital are leading the way in using modern technology to help speed up a patient's treatment ...”

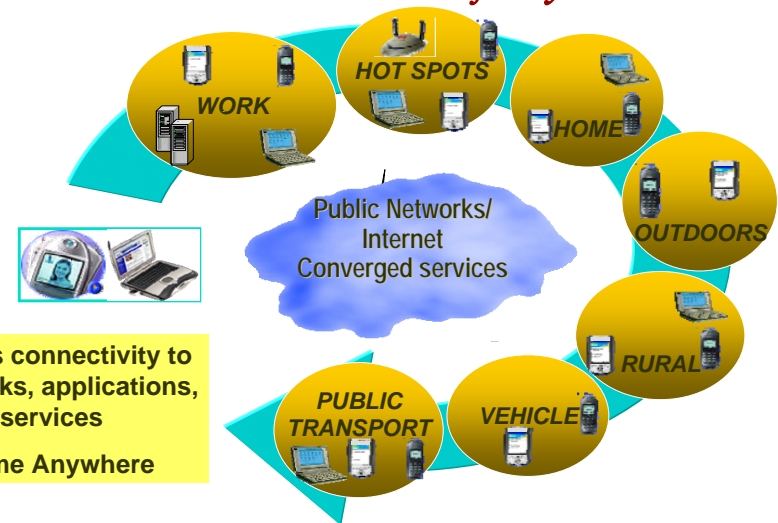


University Hospital of North Staffordshire, UK: “ Mobile telephones affect the safe operation of sensitive medical equipment we use to treat patients for example, syringe pumps, ventilator equipment or pacemakers and because of this the use of mobile telephones is not permitted in hospital buildings and within 3 meters of the exterior of any building. The use of mobile telephones in hospitals can also disturb other patients. When you come into hospital please leave your mobile telephone at home and please ask your relatives and friends to remember to turn off their mobile telephones before entering hospital buildings. “



"No, you weren't downloaded. You were born."

Wireless Future : A Seamless Mobile Lifestyle



Challenges

- Social (e.g. children's use)
- Political (e.g. posting false info)
- Policy (e.g. access)
- Legal (e.g. copyright)
- Technical (e.g. security)

These fundamental issues are closely intertwined and must be addressed if we are to realize the opportunities before us.

A Favorite 2.4 GHz Antenna



Questions?
Comments?